Some Jurassic fossils from Western Australia by F. W. Whitehouse, M.Sc.

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The fossils described below form part of a collection (now lodged in the University of Sydney) made by Dr. W. G. Woolnough, at a locality east of Geraldton.* Though a small collection and, unfortunately, largely fragmentary, it is nevertheless a welcome addition to the Jurassic fauna of Australia, and affords some valuable evidence in considering the age of the deposit.

The fossils, which for the most part are in excellent preservation, occur in a yellowish to brownish matrix highly calcareous and with occasional quartz grains.

Description of the Species.

ECHINOIDEA.

Genus CIDARIS Leske.

Cidaris sp.

(Pl. I., figs. a, b.)

There is one cidarid spine, broken at the extremities, which differs in ornamentation from all forms known to the writer. The surface is covered with rows of regularly spaced hemispherical granules super-imposed upon a finely reticulate structure in micro-relief, the points of concurrence of the bars of the reticules bearing faint secondary granules.

No form can be quoted for adequate comparison.

BRYOZOA.

Genus BERENICEA Lamour.

Berenicea cf. **archiaci** Haime.

Attached to the guard of a belemnite there is a single specimen belonging to this genus, but which is not perfect enough for precise specific determination. The zoarium is discoid, zoecia visible for their whole length and peristomes slightly raised. No gonocysts appear on the specimen.

*The exact locality, communicated to me by Dr. Woolnough, is "The Nineteen Mile, a watering stop on the Geraldton-Cue Line, nineteen miles east of Geraldton." E. de C.C.

It is very like, and may perhaps be identical with *B. archiaci* Haime* which has been recorded in Europe from the middle Lias to the Oxfordian.

LAMELLIBRANCHIATA.

Genus PSEUDOMONOTIS Beyrich.

Pseudomonotis echinata (J. Sow.).

Pl. I., figs. 2 a, b, c.

1821. *Avicula echinata*, J. Sowerby, "Mineral Conchology," vol. 3, p. 75, pl. 243.
1870. *Avicula echinata*, Moore, Q. J. G. S., vol. XXVI., p. 232.
1878. *Avicula echinata*, Etheridge, Jr., Cat. Aust. Fossils, p. 10.
1910. *Avicula echinata*, Glauert, Bull. West. Aust. Geol. Surv., No. 36, p. 100

This identification is based on a single specimen, but it is an excellently preserved left valve free from matrix. A very careful comparison was made between this specimen and a large suite of individuals from the Cornbrash of England. It is somewhat more circular in outline and has a more pronounced division of the ribs into primaries and secondaries than the *average* English form; but the variation of the species in the Callovian covers such forms as the present.

Unfortunately the range of the species in Europe has not been definitely established. The holotype is from the lower Callovian (Cornbrash) and Rollier† would apparently restrict it to such an horizon. But it certainly extends through the Bathonian, being met with in the Forest Marble, great Oolite, etc. Under the name *Avicula braamburiensis* Phill., Morris and Lycett figured two different Bajocian forms. An examination of the second of these specimens‡ has convinced the writer that it does not differ greatly from *P. echinata*. It may be differentiated perhaps by its larger size and the more prominent division of the ribs into primaries and secondaries (in this latter feature it resembles the Australian form). Further, there are "species" from higher horizons, e.g., *P. kiliani* Rollier§ from the Oxfordian, which are again very close to *P. echinata*. No doubt many of these similar Upper Jurassic forms represent a definite lineage, but the division into species at present is haphazard and very unsatisfactory. Until zonal work is done on the European forms it is not possible to allocate the present form with any precision. The writer believes that, when worked out, the vertical range of *P. echinata* may be rather extensive, and under that belief, would provisionally refer the Australian form to that species.

The hinge structure and muscle scar are well shown. These

*See particularly J. W. Gregory: Catalogue of Jurassic Bryozoa (British Museum), vol. I, p. 97, pl. IV., figs. 1-3.

†Rollier: Fossiles Nouveaux ou peu connus, etc. (Mem. Soc. Pal. Suisse, Vol. XL., 1914, pt. 4), p. 411.

‡Morris and Lycett: Monograph of Mollusca from Great Oolite. (Pal. Soc.), pt. 2, 1853, p. 129, pl. XV., fig. 7.

§Rollier, loc. cit. p. 407, pl. 24, fig. 5.

features, however, appear to retain a uniform character throughout the Jurassic species.

A search made in the Moore Australian collection in the Bath Museum (England) has brought to light only one fragment of the species.

Genus OXYTOMA Meek.

Oxytoma decemcostata n. sp.

(Pl. I., fig. 3.)

1870. *Avicula munsteri*, Moore (non Bronn), Q.J.G.S., Vol. XXVI. p. 232.

1878. *Avicula munsteri*, Etheridge, Jr., Cat. Aust. Fossils, p. 107.

1910. *Avicula munsteri*, Glauert, Bull. West Aust. Geol. Surv., No. 36, p. 100.

Specific Characters:—Left valve very inequilateral, bialate, transversely elongate, produced posteriorly. Main part of the shell ornamented with ten radial costæ, the intercostal spaces being almost flat and adorned with about seven fine costulæ in each case. Costæ produced ventrally as short projecting spines. Growth-lines forming concave curves in intercostal spaces. The first six costæ from the anterior end curving anteriorly; the remaining four with a posterior curvature. Anterior wing ornamented with about five costæ; the posterior wing with costulæ only. Right valve unknown. Hinge line of the normal *Oxytoma* type.

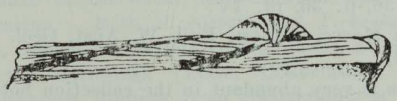


Fig. 1.—Hinge Structure of *Oxytoma decemcostata* n. sp. (left valve). × 4.

Obs: In the opinion of the writer, *Oxytoma* (genotype *Avicula munsteri* Bronn) is sufficiently different from *Pteria* to be regarded as a separate genus rather than a subgenus according to general usage. As with so many of the Jurassic lamellibranchs the divisions of the genus are not well understood. There is, e.g., no information regarding the relation of the coarsely costate (e.g., *O. costata* J. Sow*) and the finely costate forms (e.g., *O. munsteri*† Bronn). The two types often occur together, but whether this indicates two separate lineages, repetition of coarsely costate forms from a finely costate stock or even a type of species dimorphism, has yet to be worked out. It may be noted in passing that, in the Moore collection from Western Australia, one coarsely costate *Oxytoma* and three finely costate forms similar to the holotype occur.

*J. Sowerby "Mineral Conchology," Vol. III. p. 77, pl. 244, fig. 1., lower figure.

†See Goldfuss "Petrefacta germanica," T. 2, 1836, pl. 118, fig. 2.

The delimitation of European species is not particularly definite. The specimens recorded by Moore as *A. munsteri* Bronn have been examined by the writer and are cospecific with the present specimen. The species differs from Bronn's type (as figured by Goldfuss*) mainly in possessing fewer ribs. It apparently belongs to the lineage of *O. munsteri* Bronn and *O. scarburgensis* Rollier†; for in shape and costal curvature it approaches closely to this assemblage. There are certain forms in the Jurassic, e.g., the lower Lias *O. sinemuriensis* (d'Orb.), which have 10 or 12 costæ, but no such form approaches particularly close in the other features. If comparison may be made with the coarsely costate forms, then *O. notabilis* Ter. et Joudy‡ and *O. costata* Sow are worthy of notice.

Genus TRIGONIA Bruguiere.

Trigonia moorei Lycett.

1870. *Trigonia Moorei* Lycett, Q.J.G.S., Vol. XXVI., p. 254, Pl. XIV., figs. 9, 10.

1877. *Trigonia Moorei* Lycett, British Fossil Trigoniæ (Pal. Soc.), p. 151 (text figure).

1878. *Trigonia Moorei* Etheridge Jr., Cat. Aust. Fossils, p. 113.

1903. *Trigonia Moorei* Chapman, Trans. Proc. Roy. Soc. Victoria, Vol. XVI. (n.s.), p. 327.

1904. *Trigonia Moorei* Etheridge Jr., Recs. Aust. Mus., Vol. 5, pt. 4, pl. XXVII., figs 3, 4.

1904. *Trigonia Moorei* Etheridge Jr., Bull. W. Aust. Geol. Surv., No. 36, p. 36, pl. IV.

1904. *Trigonia Moorei* Glauert, Bull. W. Aust. Geol. Surv. No. 36, p 101.

This species is very abundant in the collection both in the form of testiferous examples and internal casts all excellently preserved. There is a certain amount of variation within the species shown in the shape of the shell and the thickness of the ribs. The following table is an attempt to show the shape variation graphically, the measurement taken being indicated by the accompanying text-figure.

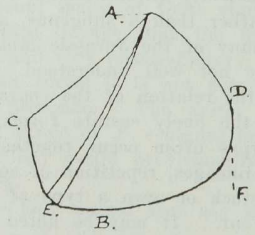


Fig. 2.—*Trigonia moorei.*

*The species was not figured by Bronn.

†Equivalent to the *Avicula munsteri?* of Morris and Lycett. (Pl. XIV., fig. 6.)

‡Terquem et Joudy: Monographie de l'Etage Bathonien. (Mem. Soc. Geol. France Ser. 2, vol. IX., 1869), p. 128, pl. XIII., figs. 9, 10.

SPECIMEN.	Valve.	CD.	100 AB. / CD.	100 EF. / CD	100 CE. / CD.
1. Holotype (Moore Coll.)	Right	48 mm.	95	80	56
2. Moore Coll. (fig. d. Lycett).	Left	61 „	103	87	52
3. Moore Coll.	Right	53 „	100	81	44
4. Moore Coll.	Left	46 „	96	86	54
5. Woolnough Coll.	Left	53 „	96	85	48
6. Woolnough Coll.	Left	30 „	98	88	56
7. Queensland Museum Coll.	Right	48 „	94	85	58
8. Queensland Museum Coll.	Left	51 „	101	83	51

The species has been carefully dealt with by various authors on former occasions; but further remarks on its affinities may not be out of place The presence of a sulcus instead of the median carina on the area renders the form distinct from most of the costate forms from England that have been figured by Lycett. Indeed only one of his specimens,* a rather unusual form of *T. costata* J. Sow. is comparable in this respect. Lycett regarded *T. costata*† as the species most similar to *T. moorei,* though he also remarks on the resemblance to *T. sculpta*‡ Lye. In the opinion of the writer the latter species among English Trigoniæ is perhaps nearest to *T. moorei;* for in general dimensions and the intensity and curvature of the ribbing on the anterior portion of the shell the two show close agreement. The English form differs, however, in the coarseness of the areal ornamentation and the presence of the median carina. Both *T. costata* and *T. sculpta* are Inferior Oolite species, though the variety *rolandi* Cross, of the latter species ranges into the Cornbrash (Lower Callovian). The Aalemian species *T. alemanica* Rollier§ from Switzerland is closely comparable with *T. moorei,* the differences being mainly of shape. The Swiss form possesses very similar ornamentation; and in the condition of the ante-carinal sulcus, the presence of a median sulcus in place of a second carina and in the general ornamentation of the area it has a striking resemblance to the present species.

Dr. Kitchin, when dealing with the rich Trigonia fauna from Cutch (India), remarked at length upon the resemblance between *T. dhosaensis* Kitchin¶ and *T. moorei.* While admitting this similarity the author would suggest that *T. brevicostata*‖ Kitchin and *T. distincta* Kitchin** are more akin to *T. Moorei* than the former species. All three are closely comparable in antecarinal

*Lycett, Monograph British Fossil Trigoniae (Palaeont. Soc., **1877**), pl. 29, fig. 6.

†Lycett, loc. cit. (1870), p. 254 and 1877, p. 151.

‡Lycett, loc. cit. (1877), p. 159.

§Rollier, loc. cit., p. 65, pl. 6, fig. 6.

¶Kitchin, Jurassic Fauna of Cutch II. (1), Trigonia. (Pal. Indica ser. IX., vol. III.), p. 29, pl. III., figs. 1, 2.

‖Kitchin, loc. cit., p. 23, pl. II., figs. 3, 4, 5.

**Kitchin, loc. cit., p. 25, pl. II., figs. 6, 7.

and post carinal ornamentation and in general dimensions. *T. dhosaensis* comes from the upper part of the Charee series, while the other two species are lower Charee forms. The Charee group, it may be noted, is the equivalent of the major portion of the Callovian. Of the Indian Trigoniæ perhaps *T. distincta* alone is comparable in the presence of the median sulcus instead of a carina, though this feature is probably of little systematic value.

All the specimens of *T. moorei* examined have had the umbones slightly worn so that observation on the ornamentation of the initial stage is not possible.

Trigonia moorei Lyc. var.

There is one specimen, an incomplete right valve which differs from the normal *T. moorei* as follows:—

1. The ante-carinal portion is relatively wider.
2. The escutcheon (i.e., posterior to the third carina) is slightly more insunken.
3. The angle of divergence of the teeth is greater. (In the accompanying figure ABC = divergence in the holotype of *T. moorei*, ABD = divergence in the present variety).

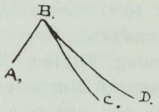


Fig. 3.—*Trigonia moorei* var.

The proportions given in the order noted above are 33 mm. 91, 94, 55.

Genus OSTREA.

Ostrea sp.

The fragments of this genus are not specifically determinable.

AMMONOIDEA.

Genus OTOITES Mascke.

Otoites depressus n. sp.

(Pl. I., figs. 4, 5, 6.)

This species is represented by the impression of one complete individual (holotype) and several fragments. The dimensions are as follows:—

Diameter (at last available point)	35 mm.
Height of last whorl (as percentage of diameter) ..	23
Thickness* of last whorl (as percentage of diameter)	50
Width of umbilicus (as percentage of diameter)	57

The last whorl of the holotype has nineteen ribs which bifurcate or trifurcate at the umbilical bulla. (There are about 43 ribs crossing the venter of the last whorl). The umbilicus is deep, whorl section depressed and venter evenly arched. The

*This measurement is somewhat approximate.

suture line is simple with broad semi-circular saddles and narrow lobes. The tubercle is situated at the junction of L_2 and S_1, and on the inner line of the lappets. Lappets are spoon-shaped, connected by an annular band.

The genus was established by Mascke* for *Am. sauzei* d'Orb† (genotype), *Am. contractus* J. Sow‡ and 15 new species. The description of the latter has not appeared up to the present. Two other species, however, *O. delicatus* Buckm.§ and *O. braikenridgii* (J. Sow¶) have since been referred to *Otoites*, while *Sphaeroceras semiornatus* Crick‖ from Western Australia represents another species of the genus. The writer has examined Crick's collection (now in the British Museum) and believes that the *Stephanoceras Australe* Crick** and *Sphaeroceras* (?) *Woodwardi* Crick†† may possibly belong to *Otoites*, though, from the crushed and imperfect nature of the holotypes, they are difficult to determine definitely.

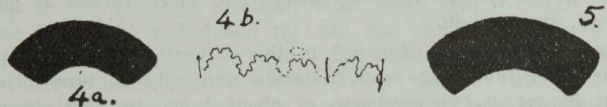


Fig. 4.—*Otoites depressus* n. sp. *a*, Whorl section; *b*, Suture line.
Fig. 5.—*Otoites* sp. Whorl section. All natural size.

In suture line *O. semiornatus* is very close to *O. depressus*, but the two forms differ in involution and ribbing. In general shape *O. sauzei* is exceedingly close, but differs in having a smaller umbilicus and more elongated saddles on the septal suture. *O. contractus* is probably even nearer, for like *O. sauzei* it agrees with the present form in number and condition of the ribs, but approaches closer in whorl shape and suture line. *O. braikenridgii* and *O. delicatus* have finer and more numerous ribs, but the whorl section of the latter species is perhaps closest to *O. depressus*. The suture line of these two species is unknown.

Otoites sp.

(Pl. II., fig. 7, a, b, c.)

Another species of *Otoites* is represented by fragments only. It differs from *O. depressus* to which it is very closely allied in having a still more depressed section and finer ribbing. The de-

*E. Mascke; Die Stephanoceras-Verwandten in den Coronatenschichten von Norddeutschland. (Inaug. Dissert. Gottingen, 1907), p. 25.

†d'Orbigny, Paleontologie Francaise, Terrains Jurrassiques, vol. I, pl. 139.

‡J. Sowerby, loc. cit.

§S. S. Buckman, "TypeAmmonites," vol. III., pl. CXLI.

¶See Buckman, loc. cit., vol. II., pl. LXXXI. This is not to be confused with **Am. braikenridgii** d'Orb, the genotype of **Normannites** Mun.-Chal.

‖Crick, On a collection of Jurassic Cephalopoda from Western Australia. (Geol. Mag. Dec. IV., vol. I, 1894), p. 484, pl. XIII., fig. 1.

**Id., p. 391, pl. XII., fig. 4.

††Id., p. 433, pl. XII., fig. 6.

pression of the whorl section reaches a maximum in this species for all known members of the genus. The suture line is very similar to that of *O. depressus*.

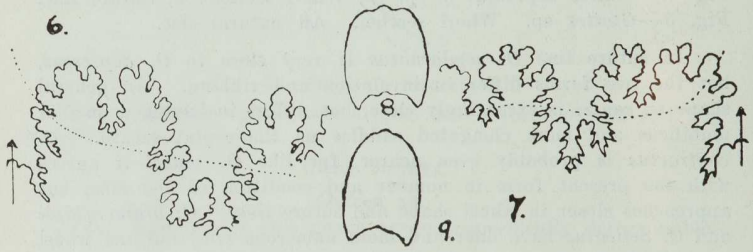
Genus SONNINIA Bayle.

Sonninia spp.

In the collection there are numerous fragments which may be allotted to *Sonninia*. No portion unfortunately shows much more than a third of the whorl; but the whorl section, the carinatisulcate venter, the direction of the radial line and the details of the septal suture agree in all cases with those of Bayle's genus. Several species (at least three) are present and all have features which would place them among the late (degenerate) forms of the genus.

Sonninia makes its first appearance in the *concavum* zone, where it has its maximum development, and extends vertically as far as the *Stemmatoceras* zone, though how much further it goes, if at all, is uncertain.

In the fragments preserved in this collection the ornamentation is never tuberculate and the costæ can only be termed prominent in one or two specimens of about 1 cm. in whorl height. All the larger fragments(they are all internal casts) have sub-



Figs. 6-9.—*Sonninia* sp.;
6, 7.—Suture lines of two species.
8, 9.—Whorl sections of two species.
(All natural size.)

costate to smooth whorls. This paucicostate ornamentation, while it is found in certain low forms, e.g., *S. contusa* Buckm., is characteristic of the later species; and its occurrence on all the species of the present collection favours a late horizon in the Sonninian range. The broad-stemmed lobe of the septal suture, which again characterises the present forms, is apparently also a late feature. Further, an advanced stage is shown by the condition of the venter. A comparison of venter and dorsum shows that the carina in each case is hollow and non-septate; and, on one specimen, while the dorsum shows a faint carinatisulcate condition, the venter has become almost smooth.

Until more complete specimens are available comparison with established species cannot be pursued in greater detail.

Dorsetensia clarkei Crick*, which the author believes to be also a *Sonninia*, does not appear to be represented in the collection. Etheridge† has misinterpreted the latter species; for the specimens which he identified under that name are identical with the "*Ammonites Aalensis* var *Moorei* Lycett," of Moore. The species has nothing to do with *Dumortieria moorei* (Lycett), and represents a hitherto unnamed species of *Dorsetensia* proper, for which the name *Dorsetensia etheridgei*‡ is now proposed. The relationships of the species will be discussed in a forthcoming paper.

Gen. INDET.

One large ammonite in the collection cannot be definitely determined generically. It is represented by one complete whorl with a diameter of 1150 mm., and umbilical width of 650 mm. One side of the whorl is badly damaged, so that the thickness is unknown. The whorl is coronate with a single row of very large bosses at the umbilical shoulder, from which ribs trifurcate. The venter is plainly arched and the ribs not prominent. No suture line, unfortunately, can be seen. In ribbing, crassi-tuberculation and lateral dimensions the species would agree very well with *Teloceras*, but there is reason to suppose that the whorl section may not support this. It may perhaps be another and unnamed coronate genus of the Stepheoceratidæ; but until better specimens come to hand this cannot be ascertained. It may be mentioned that the genotype of *Teloceras* is *Ammonites blagdeni* J. Sow. Under the name *Stephanoceras blagdeni* that species was recorded from Western Australia by Neumayr§, but his identification is in error.

BELEMNOIDEA.

Genus BELEMNOPSIS Bayle (em. Stolley).

Belemnopsis spp.

Pl. II., figs. 8-15.

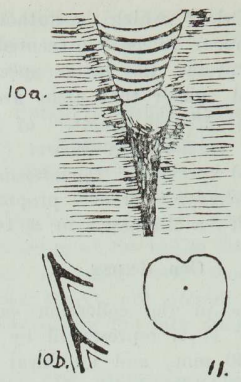
Members of this genus constitute the major portion of the collection. More than one species appears to be present, but only three young individuals have complete guards. The rest of the collection consists of fragments. The guards are cylindrical, though some young forms are subclavate; cross section is circular and the ventral groove is deep narrow and persistent throughout. A short antero-dorsal groove is also present, somewhat prominent in young specimens, but decreasing in intensity with age. The structure of the septa is of the normal type.

*Crick, loc. cit., p. 388, pl. 12, fig. 2.

†Etheridge, Oolitic Fossils from the Greenough River. (Geol. Surv. West. Aust., 1910, Bull. 36), p. 38, pl. VI., fig. 4, IX., fig. 7.

‡Holotype: Etheridge loc. cit. (1910), pl. IX., fig. 7. The dimensions of the specimen figured by Moore are 58, 31, 19, 46.

§Neumayr: Die geographische Verbreitung der Juraformation. (Denk. d. k. Akad. Wiss. Wien. Math.-Nat. Kl. Bd. L., 1885), p. 118, pl. 1, fig. 3.



Figs. 10., 11.—*Belemnopsis* sp. *10a*, lateral section of alveolar apex (× 15): *10b*, structure of septa, highly enlarged (about × 80); *11*, transverse section of guard (natural size).

Boehm has separated the group of *Belemnites meyrati* Oost. from *Belemnopsis* under the name *Dicoelites**, the genus being distinguished by its antero-dorsal groove. The relations of the two genera have not been worked out. An examination of the canaliculate belemnite of the Jurassic shows that an antero-dorsal groove is present in forms from most horizons. In some species the groove is prominent, in others it is faint; in others again it is difficult to say whether it is present or not, while in some forms it is definitely absent. No work has ever been done on the zonal changes of the group, and most authors have neglected to record the dorsal groove when it is but faintly shown. It might appear that two lineages are present throughout the major portion of the range of *Belemnopsis*. But the writer believes that the faint dorsal groove is a natural feature of *Belemnopsis* of varying intensity, sometimes disappearing altogether. In certain forms it seems as if the groove may or may not be present in the same species. The present specimens all possess the feature, though in the specimen referred to *Belemnites canaliculatus* Schloth by Moore† the groove cannot be seen.

Comparison with extra-Australian species is difficult for similar forms occur at many horizons. The Aalemian *B. subblainvillei* (Eud-Desl)‡ is similar, but it is not known whether a dorsal groove is present. The Bajocian *B. blainvillei* (Voltz)§, apparently the

*Boehm: Neues aus dem Indo-Australischen Archipel (Neu. Jahrb. f. Min., etc., Bd. XXII., 1906), p. 389.

†Moore, loc. cit., p. 230, pl. 16, fig. 7. The specimen has been seen by the writer. The apparent absence of the groove may, however, be due to the imperfection of preservation of the specimen.

‡Eudes-Deslongchamps: Le Jura Normand (Paris 1878), p. 60, pl. VII., figs. 5-9.

§Voltz. Observations sur les Belemnites. p. 57, pl. 1, fig. 9.

descendant of the latter species, is also closely comparable. Specimens occurring in the *Garantiana* zone of England, which may belong to the latter species have dorsal grooves of similar intensity to those on the present specimens. The Bathonian *B. bessinus* (d'Orb)* greatly resembles the present forms, but its dorsal features are unrecorded. The Oxfordian *B. tanganensis* (Futt)† from East Africa is again similar but more clavate; while the unfigured fragments from an indefinite horizon in Somaliland recorded by Crick‡ are very like the present fragments in being of a cylindrical form circular in section and apparently with a very similar ventral groove. Two of the species recorded by Boehm from the Dutch East Indies *(B. alfuricus* Boehm§ and *B. galoi* Boehm¶) may be cited for comparison. That collection was referred to the Oxfordian, but both Callovian and Oxfordian ammonites appear to be represented. Most of his specimens from Wai Galo seem to be derived from the bed of a creek (the belemnites, however, being found in situ associated with *Phylloceras),* so that the horizon of the two species quoted is not definite. Of the specimens referred to *B. alfuricus,* those illustrated in the text are most similar to the Australian forms.

It may be mentioned, in passing, that while all species of canaliculate belemnites with anterodorsal grooves cannot be referred to *Dicoelites* the genus may perhaps be retained for the late *meyrati* group.

Age of the Deposit.

The uniform character of the matrix suggests that the specimens are derived from one horizon. The only facts of association to be noted are that a *Trigonia moorei* occurs in the matrix of the holotype of *Otoites depressus,* while in another specimen *Trigonia moorei* and a *Belemnopsis* are associated.

Owing to its limited stratigraphical range the genus *Otoites* is of paramount importance in a consideration of age. According to Mascke it ranges through the three zones of *Emilcia, Otoites* and *Stemmatoceras* of the middle Bajocian. Should the undetermined genus prove to be *Teloceras,* as is indeed possible, greater precision in determining the age of the association is possible, for that genus is recorded from the *Stemmatoceras* to the *Garantiana* zone (*fide* Mascke). Degenerate Sonniniæ similar to the fragments described above occur in the zones of the Middle Bajocian roughly equiva-

*See Phillips: Monograph British Belemnitidae **(Pal. Soc. 1868), p.** 106, pl. XXVI., fig. 6, 3.

†Futterer; Beitrage zur Kenntniss der Jura in Ost-Afrika. (Zeit. d. deut. geol. Gessell, vol. XLVI. 1894), p. 30, pl. V., fig. 2, 3.

‡Crick, Notes on some fragments of Belemnites from Somaliland. (Geol. Mag. Dec. IV., vol. III., 1896), p. 296.

§Boehm, Beitrage zur Geologie von Niederlandisch-Indien (Palaeontographica Supp. IV. Lief. 2. Abt. I., Ab. 2, 1907), p. 57, pl. VIII., figs. 4-11.

¶Ib. (Ab. 3.), p. 66, pl. X., figs. 1, 2.

lent to those of the range of *Otoites*, so that confirmatory evidence for a Middle Bajocian age is thereby afforded.

The *Pseudomonotis*, *Oxytoma* and *"Cidaris,"* as indicated above give little definite evidence regarding the age; while the *Trigonia*, *Belemnopsis* and *Berenicea* have been shown each to have affinity with forms ranging from at least as low as the Aaleman to the Oxfordian. These members of the fauna, then, while giving no precise evidence themselves, in no wise invalidate the evidence given by the Ammonites. The fossils would thus indicate a middle Bajocian age; and it appears that they may even be derived from a single zone to be correlated with one of the three zones represented in Europe by the range of *Otoites*.

Further remarks on the age of the Jurassic beds of Western Australia as a whole are deferred until, in a later paper, the writer has an opportunity of revising the collection described by Moore and Crick.

The writer would wish to record his indebtedness to Sir Edgeworth David and Mr. W. S. Dun for allowing him to examine the collection; to the authorities of the British (Natural History), and Bath Museums for permission to consult type collections, and to Dr. H. Schmidt, of Gottingen for the loan of a copy of Mascke's Vorbericht.

EXPLANATION OF PLATES.

(All figures natural size except 1b and 2c.)

I.

1. *Cidaris* sp. *a*, Imperfect spine; *b*, ornamentation of same (× 6).

2. *?Pseudomonotis echinata* (J. Sow). *2a*, exterior; *2b*, interior, of shell; *2c*, ornamentation (× 4). Owing to the fact that in *2a* all the ribs are drawn of equal intensity, the appearance of the figure is a trifle misleading. The ornamentation of the central portion is, however, enlarged in *2c*.

3. *Oxytoma decemcostata* n. sp. Left valve.

4-6. *Otoites depressus* n. sp. *4*, artificial impression taken from the holotype (an external mould); *5a*, ventral view of aperture of a fragment (internal cast) showing lappets and connecting band; *5b*, the same specimen in lateral view; *6a*, another speci-

men (internal cast) consisting of portion of body chamber, ventral view; *6b*, the same specimen in lateral view.

II.

7. *Otoites* sp. *7a*, sectional view of portion (body chamber) of an internal cast; *7b*, the same specimen in lateral view; *7c*, the same specimen in ventral view.

8-15. *Belemnopsis* spp. *8-10*, *13-15* ventral view; *11*, dorsal view; *12*, sectional (lateral) view; *9,10*, two young individuals, possibly of different species.; *11*, a young specimen with pronounced antero-dorsal groove; *13*, the largest specimen; *14*, *15*, two different types of apex.

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